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THE GEOGRAPHICAL DISTRIBUTION OF FISH IN THE UNITED STATES.

By Robert B. Roosevelt,
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In speaking of the geographical distribution of fish throughout the United States, it will be necessary for me to explain somewhat their habits and manner of propagation. The influences which determine their localization are not difficult to be understood, and are attributable to their surroundings as applied to their specific characteristics. Fish requiring certain conditions of water, temperature and food are found, and can only be found where those requisites exist. The botanist can predict the character of the flora of any region of country when informed of the nature of its soil and of its climate. He knows that it is useless to look for the hard woods and the gorgeous flowers of the tropics under the cold skies of the far north. He can trace from the extreme limit of human exploration towards the Pole the gradual change of the productions of the earth, through the moderate climes of the temperate zones to the torrid heats of the equatorial region. Every degree of latitude marks some small difference in an arrangement which cannot be altered except by moving the poles of the planet, or by bringing to the fervid South the perennial snows of the frozen Arctics.

So the student of ichthyology—ichthyology in its broader scope, as understood by modern inquiries to be an investigation of the habits of fish and not their mere classification into arbitrary divisions — can determine, when he learns the peculiarities of the waters of any section of country, what fish will be found in them. The spruce tree of the North cannot exist at the South. The palm, the date, the mahogany of the South would perish under the first snow storm of the North.

In like manner the salmon and trout which delight in the freezing limpid mountain brook, made up of springs bursting at every turn from the hillsides, would die instantly if transported to the over-heated waters of some sluggish Southern stream. The nature of the fish is controlled by the nature of the element in which they live and cannot be changed to suit other and unnatural conditions. Yet so little thought has been given to this subject that a simple proposition like this is often not known to those who desire to undertake the artificial cultivation of fish, and discouraging failures are continually reported in attempts at fish culture where a few moments of intelligent investigation would have demonstrated the impossibility of success. A consideration of the marked traits of each variety of fish is, therefore, necessary in discussing the area of territory throughout which it is distributed. By proceeding in this way we shall learn not merely where it is found but why it is found there.

The special fish of the New England States is the salmon, the true salmon, *salmo salor* of Europe, and not the California salmon, or *salmo quinuat* of the Pacific coast.

I shall confine my remarks to our own country, not even crossing the border into the neighbor land of Canada unless by way of illustration now and then.

Salmon were never found West and South of the Connecticut river. A few may perhaps have lived in the small adjacent streams, and a straggler may, occasionally, have lost his way and wandered into the Hudson, or even gone as far astray as the Delaware, but, as a body, they did not exist in New York or any State to the South of it. It has been a tradition, on the authority of Hendrick Hudson, that "great stores of salmon" once inhabited our famous river, but it is now conceded that he must either have referred to shad or weakfish, probably the latter, both of which enter the harbor at certain seasons in large shoals. Even to this day the weakfish is miscalled in parts of the country after his nobler brethren in Pennsylvania, becoming a "Susquehanna salmon," and in Florida a "salt-water trout."

All the important rivers of New England were once filled with salmon. This would be the case still were it not for dams and obstructions which prevent their performing the necessary functions of procreation. The inordinate fishing of New Englanders, who seem to be gifted with special skill in discovering murderous methods of destroying the wild inhabitants of our forests, field and waters, would not wholly have prevailed against them, had not their habits been interfered with and their liberties annihilated.

Salmon are anadromous. They pass most of their time in the sea, to which they have an irresistible impulse to descend if they can possibly do so as soon as they attain the proper age; but they must ascend into cool, clear water to deposit their eggs. It would be impossible, in the short time which I can command from your attention, to enter into all the particulars of their method of propagation, but as the eggs have been hatched by man from the moment of their extrusion to their change into that of young salmon, all the necessary conditions for their perfect development are fully known. Two requisites, however, may be mentioned, first, purity of water, secondly, a cold temperature. A glance at the map will show how admirably the rivers of New England furnish these essentials. They all rise amid the mountain tops of Maine, New Hampshire or Vermont. Pellucid and cold as the springs in which they have their source, those springs often segregated into ponds or lakes which are in fact but larger springs, they pour down to the South and Southeast, with few falls but many rapids, till they reach the sea. In the upper waters salmon find all the requisites for laying and hatching their eggs and continuing their species. At the outlet lies nature's storehouse, the ocean, from which they draw unlimited rations. The passage from one place to the other was not difficult nor tedious.

Of course, salmon were found where nature had so accommodated itself to their habits, and they existed in no limited numbers. The rivers swarmed with them; from them was furnished a large portion of the food of the inhabitants; fresh, salted or pickled they were a national resource of vast magnitude and value. Millions of dollars yearly would not represent the extent of their commercial value had their abundance not been diminished. They cost nothing; they fed themselves, they required no tillage, no manure, no care. They looked after their own affairs. From the worthless productions of the sea, shrimp and snails and minnows, they drew their support. When they were large enough for the table, they left their distant haunts and came into man's jurisdiction. They crowded up to his home, to his very door and waited only to be taken out and converted to his use. So magnificent and generous a heritage should have been guarded with care, but the inhabitants thought otherwise. Instead of protecting and developing it, they destroyed it. Impassable dams were erected across these rivers, the conditions were changed and salmon disappeared almost as though they had never been.

I have said that the eggs would only hatch where the water was cold and limpid. The fish, even, will perish when the temperature of the latter rises too high. Here are conditions which are obligatory: If the eggs are deposited in warm, muddy or brackish water, none of them will ever hatch. It is not a question of a per centage of loss, but all perish; not a single egg will develop. The dams erected on the rivers of New England forced the salmon to spawn their eggs in the warm, foul and sluggish water — if they spawned at all — and the consequence to-day is that not a single salmon is taken in the Connecticut nor in any Eastern river across which has been thrown an impassable dam.

Trout are found in all rivers in which salmon can hatch their young; but as they are not necessarily migratory, they often dwell where salmon cannot. Trout require a temperature of water never exceeding 70°. At 65° they begin to suffer; at 70°, unless there is a strong and broken current to give life to the water, they die rapidly, and not one will survive a temperature of 75°. It is simply manifest, then, that the Southern and Western rivers are not inhabitable for trout or salmon. Trout may be found in the head-waters of such as rise in the Alleghany range of mountains, but salmon can exist in none of them. So, also, with the sluggish, muddy rivers of Ohio, Indiana, Illinois, Missouri and the vast central region of our continent. Throughout the entire section between the Alleghanies and Lake Superior and the Northern Mississippi, no trout are found; and then, again, not till you come to the Rocky Mountains. Trout and salmon, except in the matter of migration, are similar in their habits. The eggs of either may be hatched in the same boxes with the same water, in the same time and under the same treatment. This is being done to-day by the New York Commissioners of Fisheries at the State hatching-house at Caledonia. There are trout (*salmo fontinalis*), salmon (*salmo salor*), and lake trout (*salmo confinis*), all being hatched side by side in the same building, in identical troughs and with the same water.

In lieu of the salmon the special migratory fish of the lower Atlantic States is the shad. Shad also visit the New England rivers for the reason that they can time their appearance to the proper temperature of the water, and during the warm weather the latter is sufficiently high. Their eggs hatch best in a temperature of from 65° to 75°, 80° being the extreme limit. This is 20° higher than for trout. In February shad make their appearance in the rivers of Florida, gradually showing themselves to the northward as the spring advances. In May they are in Virginia, in June in New York, and in July further North. The fish culturalist may follow them along and hatch them in every river. They do not ascend to the extreme sources of the streams they visit, contenting themselves with stopping here and there above the salt or brackish water, and depositing their eggs in any convenient and appropriate locality. They are much more prolific than the *salmondiæ*, their eggs hatch in one-tenth the time and they are far more easily and cheaply handled. Their care and protection is a matter of national interest. No fish is so easily multiplied, none has been previously so abundant in our country, and none is so truly the food of the people.

Salmon trout, which are sold at from half a dollar to a dollar a pound in our market, are the delicacy of the rich. Circumstances will prevent their ever being very abundant with us, but shad are the property of the poor; they are still moderately cheap, being made so by the efforts of the Commissioners of Fisheries of the Middle and Eastern States, and their numbers can be augmented indefinitely. A few years ago contracts were made for the wholesale delivery of shad for eighteen dollars a hundred. This price would have advanced with each succeeding season. Fisheries were ceasing to pay expenses even at that extravagant price. Their proprietors were giving up the business and selling their nets. The utter annihilation of this species of fish was rapidly approaching, and was only prevented by the vigorous efforts of the Fish Commissioners. Millions of shad were hatched in the Hudson, Connecticut and other rivers; their numbers rapidly increased, the price fell, the yield of the Connecticut became larger than it had been for half a century and shad were sold last year on the upper Hudson for three dollars a hundred.

Having thus treated of the distribution of the fish of the sea-board, let us glance at those of the interior States. The national fish of America is the black bass. Wholly unknown in European countries, it exists solely with us, where its vigor, enterprise, restlessness and independence, its athletic, but not altogether comely appearance, make it rather representative in its character. It is self-reliant, and when placed in new waters not merely makes itself at home, but appropriates the locality, explores its furthest recesses and devours its aboriginal inhabitants. Its natural distribution was through a few of the lakes of New York, but mainly in the North-Western States. It has, however, been acclimated in many other ponds and lakes, where it now flourishes extensively. A younger brother, the Oswego or grass bass is more common, and being less particular in its choice of habitation fills, often in countless numbers, the muddy and weedy ponds and streams which the true black bass disdains. These fish, together with the pike-perch *lucioperca*, a variety of which is called the Ohio salmon, people the waters of our land from New York to the Rocky Mountains, and exist here and there also, in some of the streams of the Southern Atlantic States. They have certain marked differences of habit, the black bass loves bright, pure, lively water, not as cold as the trout streams of our spring-producing hills and mountains, but free from foul matters held suspended in it and with motion either of current or from the winds. It deposits its eggs on rocky or pebbly ledges. The pike-perch lives in the great Lakes and rarely, as in the case of the smaller specimen, the Ohio salmon, remains even in the larger rivers, while the grass-bass loves muddy, weedy shores along which it lays its eggs.

None of these varieties are susceptible of artificial cultivation. The eggs, when they exude from the parent, are enveloped in a gelatinous or mucous substance which seems to be necessary to their protection. They seem to require to be in a large expanse of water with possibly gradual and gentle change, but must not be exposed to a strong current. If they are confined within a narrow space there is not sufficient oxygen in the water, and they die for want of vitalization. A few have been hatched by way of experiment, but the care required was too great for the advantage obtained. It is fortunate in this view of the case that black bass are gifted by nature with a peculiar instinct, they guard and protect their nests till the young are hatched, and even watch over the latter till they can take care of themselves. Alternately the male and female stands guard over their precious possession of infantile possibilities; if one is away scouring the country for food, the other is on the watch, fierce, brave, resolute, and woe to the unhappy intruder who would steal a dinner from the deposit of bass eggs. The bass is the tyrant of the fresh waters, even the big-jawed, snake-like pickerel cannot stand against him. His teeth are long and sharp, his mouth is large and threatening, his body is close-knit and stout, and his fins are arrowed at every point with sharp and poisonous spines. Such a creature, mounting guard over his young, is not an enemy to be despised.

Moreover, this class of fish have a comparatively low range of vital action, they can resist exposure, removal from their natural element and transportation better than trout, salmon or shad. Advantage has been taken of this characteristic to acclimatize them in waters which had previously been occupied by inferior fish. Black bass have been distributed through hundreds of ponds in New England and New York, and the Oswego bass has literally crowded the Potomac river, in which it was placed in 1859. Their natural increase is very rapid, and of the three different species one or the other is suited to almost all the streams of the lower and more level portions of our entire country.

West of the valley of the Mississippi and the great plains, among the fastnesses of the Rocky Mountains and on their western slope we again find trout and salmon. Not, however, the eastern trout, *salmo fontinalis*, or the northern salmon, *salmo salor*, but several species of large spotted trout and a new salmon called the *salmo quinnat*. Many years ago, before gold was discovered on the western coast and even, I believe, before California came within the galaxy of American States, an English admiral, stationed in the harbor of San Francisco, wrote home an account of the country. His views were not complimentary and were contained in one pithy sentence which, if you will forgive the irreverence, I will repeat. He said: "California is not worth a damn; the salmon will not take a fly." His opinion of the value of the country was notably incorrect, but one can almost forgive the disgust of an ardent fisherman when he discovers that the beloved objects of his sport have proved false to all the traditions and habits which lent them their charm. He had discovered that Pacific salmon were not the true article, and his whole idea of life was clouded in consequence. This discovery of the bluff old naval sportsman has been confirmed by the investigation of fish culturists, and it is now admitted that the California and Oregon salmon is a new variety.

Every thing in that wonderful country seems to be something new and strange. The trees have to grow hundreds of feet high, a waterfall is not noticed unless it falls a thousand feet, silver is not worth digging unless it is found in *bonanzas*, which means "chimneys" or solid columns of pure metal; and pears are thrown away as nubbins unless they are as large as cabbages. Even a quiet, modest, respectable New England pumpkin-seed, when planted in that astonishing country, feels called upon to produce a fruit big enough for an ordinary house in which Peter Piper, or any other man, could keep a wife and raise a family very well. It is not surprising then, that the salmon change their modes of life, despise feathery flies and endure a temperature of water which would be fatal to them in our more methodical land. Some of these have lately been introduced into the rivers of the Atlantic States under the auspices of the United States commissioner of fisheries, and the time may yet come when we shall have salmon in the Hudson, the Delaware, the Susquehanna, the Potomac and, perhaps, even more southerly rivers. This is but fair. A few years ago we sent shad to California, a fish which had not theretofore existed in the tributaries of the Pacific, and in return California should send us its salmon which promises to do well in rivers that are not habitable by the true salmon of the north.

I have now taken a cursory view of the geographical distribution of fish in our country and given some reasons for this distribution. I could not enter into a more extended review of the wider subject of the artificial increase of the supply. Incidentally, however, something has been shown of what has been done, but far more lies behind. The future promises great results. Not only can fish be raised as easily as vegetables are raised, but with a productiveness ten fold greater. The waters will soon teem with them, and our rivers and lakes will be cultivated precisely as the land is cultivated till they shall support acre for acre as many human beings. Nor is this all; but acclimatization has done much for the tillage of the earth, it will do as much for the tillage of the sea. New breeds of animals have been introduced in countries to whose climate they were specially adapted; care in breeding has raised others to higher development, while vegetables and grasses have been cultivated scientifically and brought into new areas where they flourished luxuriantly. The same will be done with fish. Shad will be taken to the Pacific; salmon will be brought to our own doors; the great trout of Maine, weighing ten pounds apiece, will replace the fingerlings of our brooks, and bass will abound everywhere. The entire science has been left for our day and generation when the thorough exploration of the world and the rapid increase of population make it necessary. We have only to do our duty in order to secure for ourselves and our fellow-men the full benefit of the wonderful discovery.